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METALLIFEROUS DEPOSITS OF CORNWALL AND DEVON.

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This work, the publication of which has been so long deferred, consists of a series of papers read before the Royal Geological Society of Cornwall, at various periods, with an appendix, containing observations on subterranean temperature, on the quantities of water which enters the mines, on electric currents, and statistical notices of the mines in the two counties. The subject generally is familiar to our readers, having published each paper at the time of its being read before the society in the *Mining Journal*; the whole having, however, been revised by their talented author, and collected in one volume, we shall give such copious extracts therefrom as will afford a comprehensive view of the entire volume.

In introducing his subject, Mr. Henwood observes, that these deposits may be studied in greater variety, complexity, and even extent, in Cornwall and the adjacent parts of Devon, than in few, if in any, parts of the globe. No full and detailed account of the phenomena they present in this district has hitherto been attempted; although other authors—Thomas, Carne, Boase, &c.—have given valuable contributions on the subject, they have either only treated of localities, or have slightly glanced at it, in taking a wider range of geological investigation. To supply this deficiency has been the author's object, who for twelve years devoted his leisure to the task of collecting, by personal inspection and observation in every mining field in the district, all the particulars which could throw light on the diversified modes in which the metalliferous deposits occur. The first district noticed is that of St. Just, about three miles north of the Land's End. The mines here are worked principally in the granite for tin, and in slate for copper; the junction of the two rocks are well exposed in the cliffs and beaches of Porth Just, Pollidan, and Pendeen, and the slate is traversed by veins of granite, which may be generally traced to a connection with the main body of the rock. On the north-eastern side of Cape Cornwall an enormous mass of schorl rock intervenes between the granite and slate, whilst at Pendeen the transition is so gradual, as to be almost imperceptible—the granite becoming more quartzose, and the slate more micaceous, as they approach, so that no other difference is apparent in the mass at the junction than a bluish tinge on the side of the slate, and a paler hue on that of the granite; the intersections of the veins are very unintelligible—for although, in a few instances, the *hanges* appear regular, in the greater number it is far otherwise, and in many cases, although the lode has continued rich in actual contact with the cross vein, it has never been discovered on the other side. In every vein in the district the masses of metallic minerals have dipped from the granite, and this disposition of the rocks, and the directions of the veins, directing many of the mining operations towards the sea, several of the mines are worked to some extent beneath the bed of the Atlantic, and the breaking of its waves is distinctly audible to the labourer whilst at his work. In Little Bounds, Botallack, and Wheal Cook, their hardihood tempted them to follow the ore up even to the sea, but the openings made were very small, and the rock being extremely hard, a covering of wood and cement in the two former, and a small plug in the latter mine, sufficed to exclude the water, and protected the men from the consequences of their rashness. The quantity of water throughout the district is very small, and though, in all the mines worked beneath the sea it is salt, it is not more abundant than in those further inland—whilst that from the granite is so pure as to be fit for domestic use. The most usual of the mineral produce of St. Just are vitreous copper, copper pyrites, and native copper, while some salts and other ores of this metal have been found. Oxide of tin is abundant, and the sulphuret has been found at Botallack; there have also been discovered bismuth and its sulphuret, many ores of iron, cobalt, uranium, zinc, antimony, and some other metals. Of earthy minerals, garnets, oxinite, apatite, hornblende, antynolite, schorl in abundance, arragonite, and pearl spar. Many of the mining districts of Cornwall afford more employment, and yield greater riches, than St. Just, but in its well displayed junctions of granite and slate, its rare and curious earthy minerals, its wildly and singularly-situated mines, and their subterranean and sub aqueous dangers, with its bold and romantic cliffs, it is surpassed by none of them in interest and importance. The positions of several of their engines are picturesque in the extreme; perched on the verge, even on the ledges, of a tremendous precipice, they seem at the mercy of every storm, and to the beholder from beneath, they almost appear suspended in air, and tottering to their fall, and in part of Botallack the labourers have to descend to the adit level by ladders placed on the face of the cliff. The St. Ives district is bounded on the north by the Bristol Channel, on the east by the Hayle river—having an area of about nine miles, consisting generally of upland heaths, occasionally rising into spires of considerable elevation, whose declivities are covered with enormous masses of granite in situ, but separated from the parent rock by disintegrated granite, often many feet in depth. The whole district is granitic, except a narrow border of slate on the coast. At Hudlow Green, in one of the small glens which there unite, is a formation of talcose granite (protogine), from which china clay is extracted; its extent and direction are unknown, but an excavation has been made, 600 feet long, six broad, and fifteen deep; it consists of decomposed green and yellowish felspar, pearl white talc, and quartz, with numerous small masses of schorl. The passage from the granite to the slate is gradual—the actual junctions being nowhere seen at the surface. The directions of the lodes are rather to the north of east, and south of west, and of the cross-courses within a few degrees of north and south. The veins worked in the granite are most productive for tin, and those in the slate for copper—tin being the staple commodity of the district. At the St. Ives Consolidated Mines a string or vein of tin ore, mixed with quartz, chlorite, and copper and iron pyrites, falls off from the lode towards the south in a manner quite unexampled in Cornwall, but which may have some analogy to the *pipe* veins of other districts. In some cases there is a still more extraordinary distribution; sometimes the lode becomes enlarged from a few inches to thirty or forty feet in breadth, and at others still larger masses of tin ore, wholly unconnected with any vein, surrounded on all sides by extremely hard and coarse-grained granite. An extraordinary deposit of tin ore is found in the St. Ives Consols Mines, called "the Carbona;" it joins the "Standard" lode at a depth of seventy-eight fathoms, where it is not more than four or five inches square; from thence it has been worked in a south-east direction 120 fathoms, until, continually tending downwards, it reaches the depth of 160 fathoms; its greatest thickness is about ten fathoms high and ten broad, and its average size four fathoms high by ten or twelve feet wide—its dip varying from 45° to 90°; bounded above, below, and on either side, by granite, it is composed of felspar, quartz, schorl, and oxide of tin, very irregularly aggregated, and in many parts contains chlorite, uranium and blistered copper pyrites, iron pyrites, and here and there traces of vitreous copper ore. In one place it assumes of enormous dimensions, ten fathoms in height, length, and breadth—and here the massive piles of timber to support the roof, the grotesque appearances of the miners, and the flickering lights, produce a most striking effect. The Hawsome district comprises the slate rocks, which are bounded on the west and south by the granite of Paul, Madron, Gulval, and Ludgvan parishes, and on the south by Mount's Bay. The structure of the slate formation on its shores is well exposed, and the granite is of the ordinary character, composed of felspar, quartz, mica, and sometimes schorl and pinite. The granite and the slate are alike traversed by several elvan courses, consisting more or less of a fine-grained basis of felspar and quartz, and contain large porphyritic crystals of felspar, dentiform crystals of quartz with cracks, and specules of schorl; but, in its hardness, and in the aggregation of the minerals, the mass assume frequent irregularities; they all bear north-west. The summary of this district is altogether unlike that general to the mining tracts of Cornwall; they are consistently wild, barren, uncultivated heaths, but the high cultivation and luxuriant vegetation of this district well entitle it to be called "the garden of Cornwall." The Gwinear and Camborne district is bounded on the north by the Bristol Channel, on the east by an imaginary line drawn from the sea to the eastern end of Clowance Wall, on the south by the brook which divides Roscrow from Crowan, and on the west by the river which runs from Trelissick to Hayle. Its structure is a group of slate rocks, intersected by several many-sized elvan courses—while on the coast an extensive tract is covered by a mass of drifted sand; elvan courses abound, but their directions are very various. A striking character of the strata, as well as the lodes, about Relistian, is, that they contain globular concretions—some compact slate, others schistose, and others entirely of quartz. In Herland, at 110 fathoms deep, there are numerous nodular masses of granite, which consist of a basis of felspar, with some quartz, and a little mica; they are fine-grained and decomposing, and vary in size from a nut to three feet in diameter; at both places they are entirely enveloped by the slate, and have no connection with each other. On breaking the rock it will be found to consist of large numbers of spheroidal masses, cemented together by a matrix, sometimes quartzose, and often slaty. In this district the slopes of the hills and valleys are well cultivated, and here and there they are covered with flourishing plantations, but the uplands present the usual features of barrenness in other mining districts.

The Helston district is bounded on the north by the parishes of Breage and Crowan, and by the granitic range of Wendron—on the east, by a line from Wendron Church to the sea—Mount's-bay on the south—and on the west by a line from Pra sands to Crowan; it includes parts of the parishes of Germoe, Breage, and Wendron, the whole of Sithney, and the town of Helston; it contains all the granitic tract of Godolphin and Tregoning Hills, and a part of the great central mass of granite in the parishes of Sithney and Wendron; its other rocks are massive and schistose slates, and a few elvan courses. The granite of Godolphin Hill is in general fine grained and hard, consisting of a yellowish white and pale brown felspar, quartz, and dark mica, abounding in radiating crystals of schorl; that of Tregoning Hill is talcose (or protogine), it is extensively quarried for building, and, on the western slope, it is worked for china clay, which is exported to the Potteries. The granite of the Wendron or Crowan patch is coarse-grained, consisting of a basis of compact felspar, white, greenish, or pale buff, with quartz and dark mica, inclosing numerous large crystals of white or pale brown felspar. The best known elvan course in this district is at Pra sands; it is twelve fathoms wide, and bears 35° west of north, and dips north-east 40° to 50°. Cross-courses are not numerous in the eastern part of the district, but in the western there are several, and some of the bearers are considerable. The chief mineral product of this district is tin ore, which principally occurs in lodes, but it has been found in irregular patches, and at Raggy Rowal, on the eastern side of Tregoning Hill, disseminated through the granite; it is remarkable that at Wheal Vor the richest have all been discovered in the slate, while Great Work is profitable in the granite only. The wild and romantic character of the coast is inferior to no other part of Cornwall, and Wheal Trewavas, with its engines perched on the cliffs, and its workings beneath the sea is as picturesque as Botallack or Levant, in St. Just district, before-mentioned. Camborne and Illogan district comprises portions of the two parishes, bounded on the east by the valley, which divides Illogan from Redruth—on the south by a line which passes through the ridge of Carn Brea, Carnarthers Cairn, Cairn Entral, and Camborne Beacon Hill—on the west by a line from Camborne Beacon to Camborne Church—and on the north by a line parallel to the highway from Camborne to Redruth. The rocks of this district consist of an elevated range of granitic hills on the south, covered on their northern slope by varieties of the slate formation, and intersected by several elvan courses, and numerous lodes and cross-courses. The most prevailing mineral produce of this district is copper pyrites, but several mines have also afforded abundance of native copper, and many of the more rare and splendid compounds of that mineral; large quantities of tin also have been, and continue to be, raised in Tincroft, Dolcoath, Cook's Kitchen, and Carn Brea Mines. In one of the lodes at Dolcoath much native silver, as well as vitreous and red silver ore, were found, and some of the ores of cobalt and bismuth have occurred in the same mine; the district contains several cross-courses, some of which are seen at a great depth, but do not come to surface. Carn Brea is the highest land in the district, and near its summit is a copious spring of excellent water.

Redruth and Gwennap district touches the Illogan district on the north-west; it is bounded on the west by a line drawn from Blowing-house Bridge to the Elvans Mine—on the south by a line from Elvans to Comfort—on the east by a line from Bissoe Bridge to Swanvick Water—and on the north by the Redruth and Truro turnpike-road; it includes portions of the parishes of Gwennap, Redruth, Perran-ar-worthal, Kea, and Kenwyn. Its rocks are the north-east skirt of the great granitic range of Stythians, Wendron, &c.; and the isolated mass of Carn Marth and Trefula Barrow, and the slate in contact with them; the whole traversed by lodes, elvans, cross-courses, and dunkans, and is by far the most extensive, as well as the most productive, mining district, particularly in copper ores, in Cornwall. Elvan courses are numerous; there is one at Wheal Porter, a second at Treleigh, north of Redruth, a third may be seen at the Hayle Railway terminus, a fourth in Wheal Buller, and another in Wheal Beauchamp. On the top of Lanner Hill, on the eastern slope of Cairn Marth granite, and at Treskerby, elvan courses also appear; there are also numerous cross-courses and dunkans; the latter of which often extend but a few fathoms in either direction, and vanish, as it were, roots in the middle of the lodes, neither appearing at the surface, nor descending to very great depths, some of them, however, observe much regularity in their bearing and effects. The produce of the lodes in this district is, for the most part, copper pyrites, which is raised in every mine in large quantities; vitreous, native, and the red oxide of copper have also been found in several of the mines, as also carbonates, arseniates, and silicates of copper; much tin ore has been obtained at Poldice, Unity Wood, and Bell Duer; arseniate of lead in Wheal Unity; uranite in Wheal Buller and Carharrack; flour in Wheal Unity Wood, Poldice, &c., and mineral pitch in Treskerby and East Wheal Damsel; and in other mines many rare and curious minerals; the only two manufactories of white arsenic in the kingdom are in this district, one at Perran Well, the other at Bissoe Bridge. The mines of this district are not only the most extensive and productive, but also the deepest in the county, and the great adit which empties itself into Carnon Valley a little above high water-mark, extends in its ramifications between thirty and forty miles, penetrating upwards of twenty important mines. The narrow valleys here have been streamed for tin ore at various periods, and in Carnon Valley large quantities of it have been found; at present it is worked beneath the sea in Restronguet Creek, by means of a shaft on the main land, and a level from thence beneath the sea; at high water rounds of considerable burden sail over the heads of the miners whilst at their work. From the extent of the operations below, the surface of the district is covered with rubbish, and its general aspect barren and uninviting, still the miners' cottages and the small garden plots diversify the moors, while the outskirts are well cultivated and cheered by the thriving plantations of Scorrier, Tregolles, Trevince, and Barncoose.

St. Agnes and Perranzabuloe district is bounded on the west by the parish of Illogan—on the north by the Bristol Channel—on the east by an imaginary line from the sea, at Penhale, to about a mile inland—and on the south by another line nearly parallel to the coast. The principal rock is slate, with a patch of granite at Chapel Point, the former being sometimes gradually becomes calcareous, till at Newquay it contains extensive beds of limestone, in the vicinity of which the slate contains corallines, encrinites, and other organic remains. Elvan courses are numerous throughout the district, and there are some in the calcareous beds also. At Chapel Point the cliff is pierced everywhere, and in all directions by the excavations which have been made chiefly in search of tin; wolfram is also abundant, and there are traces of copper and iron pyrites. Both the eastern and western parts of the district have produced large quantities of copper ore, generally in the state of pyrites, and some of them have afforded fine specimens of native copper, specathiform oxide, vitreous copper ore, and other salts of that metal; in the eastern part of the district some veins have produced galena in large quantities, and the first discovery of silver in Cornwall is said to have been at Wheal Maiden, in this district. A great part of it, without cultivation or enclosure, is moor, wild and desolate, but the sea coast, with its pleasant coves and sandy beaches is much resorted to, and its lofty and cultivated cliffs, whose decomposing rocks assume an endless variety of tints, attract many summer pleasure parties and lovers of romantic scenery.

The St. Austell district is bounded on the south by a line drawn from Tregaw's Gate to the sea at Porth Pean, thence by the coast as far as the eastern side of Par Sands, thence by a line extending northward to the top of Penpethick Hill—on the north it is bounded by a line from that hill to Beam Mine—and on the west by a line from Beam to Tregue's Gate; it comprises part of the parishes of St. Ewe, St. Mewan, St. Austell, St. Blazey, Tywardreath, Lanlivery, Luxullian, Roche, and St. Stephens. In the north is the high granitic range of Hensbarrow, 1026 feet above the level of the sea, and its subordinate hills, and in the south are slate rocks, which in some places contain organic remains; elvan courses are numerous throughout the western part, and in the cliff near Duporth is a small patch of serpentine. The granite here is of much greater extent than in any of the western districts; it in general possesses the ordinary character, coarse grained, and composed of felspar, quartz, and mica, and frequently much schorl; it is sometimes very talcose and decomposing, and the sides of Hensbarrow supply nearly all the china clay sent from the county to the Potteries. Almost the whole of the northern and western parts of this district yield only tin ore; but in the eastern portions copper ore prevails, generally in the state of pyrites—but the other ores of copper, and more rare compounds of that metal, often finely crystallised, have occurred at several of the mines, and in the Fowey Consols the sulphuret of bismuth is very plentiful, generally crystallised in the cavities which are found in the copper pyrites. The district affords more stream tin ore than all the rest of the county; it always occurs in a rounded form, the masses varying from the finest sand to several inches in diameter. The scenery of this district is remarkable for its variety; the coast is indented by many retired sandy coves, and often bordered by highly cultivated and well wooded lowlands; the valleys, which penetrate into the moors, are often rich and beautiful, but the highlands present the same characters of wildness and sterility which have been before described.

The eastern or Callington and Tavistock district comprises portions of the parishes of Callington, Stoke Climsland, Calstock, Tavistock, Buckland Monachorum, Sampford Spiney, Mary Tavy, Lydford, and North Bovey; it consists of the two small granitic patches at Kit Hill and Gunnis Lake, and the western part of the Dartmoor granite, with the slate rocks contiguous; the most westerly granite merely forms the summit of Kit Hill, the next of larger dimensions touches the Tamar near Calstock new bridge, and the eastern granite is Dartmoor, which does not reach so far westward as Tavistock by two or three miles. Birch Tor, a tin mine, which has been worked open to surface on small veins, like those of St. Just, St. Agnes, and St. Austell, but which veins unite in depth, and are worked by levels in the usual way, is the only work of any magnitude on Dartmoor; it is several miles from any town or village, and, from its desolation, and the severity of the climate, is worked chiefly by labourers who have absconded from other districts for offences against the laws. An elvan course occurs at East Liscombe; it is largely quarried near Greenlee, in several spots south of the Walkham River, and on Roborough Down, for building materials. The directions of the lodes are generally a few degrees south of west, but some bear north of west, most of them dipping to the north, though some few have an opposite direction; cross-courses are numerous, and their bearers considerable—at Wheal Betsy and Redmoor they have yielded large quantities of galena mixed with carbonate of iron, in granite the ore is the chief product of the lodes, at Kit Hill wolfram is plentifully found with it, and at Birch Tor with quantities of specular iron; copper ores in the state of pyrites have been abundantly found in the slate—and native copper, the red oxide, green carbonate, vitreous, and black copper ore, with other rarer compounds, and fine crystals of uranite, have been found in Gunnis Lake. At a mine called the Virtuous Lady a sort of metalliferous bed exists, containing copper pyrites, carbonate of iron, chlorite, and quartz; for the variety and beauty of its specimens, this mine surpasses all others in the district, and, from the easy means of access, is visited by nearly every visitor to Tavistock, ladies as well as gentlemen; carbonate of iron is here found of the spathose form, and in hollow cubes cast on flour spar. A most remarkable form of the carbonate of iron is peculiar to this mine, called provincially "ladies' slippers;" it consists of thin plates, the ends having the appearance of pointed arches; the carbonate presents a crystalline face on one side, while the other is perfectly smooth, and the edges turned in at an acute angle, so if cast on a substance the form of a thick laurel leaf, or some other material of such shape; the whole outer surfaces are sprangled with brilliant crystallised grains of iron pyrites—and they form bunches, intersecting each other in the most irregular and capricious manner. Galena, mixed with vitreous and red silver ore, and native silver, have been found at Wheal Brothers and Wheal St. Vincent; at Hogga Tor, in the parish of Milton Abbott, large quantities of the black oxide of manganese has been found in short irregular patches, accompanied by veins of blaper clay; stream tin ore is still found in small quantities on Dartmoor, accompanied by minute grains of gold. Nothing relieves the dreary monotony of Dartmoor, except a few rugged ravines; the roads over it are few, and the mists (locally called "gullers") so frequent and dense, that tourists seldom visit its recesses, but content themselves with the outskirts; it gives plentiful summer pasture to sheep and young cattle. The lowlands and vales are varied with the most enchanting combinations of wood and water, hill and dale, and must be seen to form an idea of their exceeding beauty.

After a recapitulation of the various rocks, their localities, and relative situations with each other, with the general character, direction, and appearance of the lodes, the author, in an appendix, gives some observations on the subterranean temperature in the mines of Cornwall and Devon, with a series of tables of the results of his experiments, and which appears to establish the fact of a progressive elevation of temperature as we penetrate further into the crust of the earth. He proceeds to the important question of the quantity of water which enters the Cornish mines, and he calculates the amount which flowed through the great adit in 1839 and part of 1840, that if it had to be raised to the surface of the mines would have required an annual increase of coal of 24,000 tons—thus saving 10,000*l.* per annum in the mines which it conveyed, for fuel alone. This magnificent undertaking, which we have before noticed, has a course of between thirty and forty miles, seventeen acres of the largest mines in Cornwall; and was commenced in 1748, by an member of the respected family of Williams, of Scorrier House.—This part of the work contains a deal of tabular matter, showing that in shallow wells and deep mines the results are the same—viz., that rain water is more readily absorbed by and percolates more freely through the rocks of the granitic formation than those of the slate series.

From his experiments on the electric currents in the lodes of Cornwall, it appears that out of the sixteen observations on vertical currents, nine, or 56·3 per cent., had a downward direction, and seven, or 43·7 per cent., an upward one. In twenty-six observations made on currents flowing horizontally, seventeen in lodes dipping north; currents went to west but, or 58·6 per cent., deflected the needle 62°; and currents went to east seven, or 37·9 per cent., deflection 58°; and nine on lodes dipping south; currents went to west one, or 3·8 per cent., deflection 60°; and currents went to east eight, or 30·9 per cent., deflection 66°. In sixteen experiments on vertical currents an equal number of the lodes had opposite dips. In five experiments, connecting two lodes at similar levels, the currents passed from the northern to the southern point; and in six experiments on parallel lodes, at different levels to one mine 10·6 per cent. the current was ascending, but in the other five, 69·4 per cent., they descended.

An inquiry of great practical importance connected with this subject is, whether the direction or quantity of electricity has any relation to the positions of the largest masses of ore. Of twenty-five experiments on lodes, of which the richest parts were known with tolerable certainty, the following is the result:—

In every case in which Weekes's and Hill's galvanometer was used, the presence of electricity was detected, both in the copper and lodes, though far less abundant in the former than the latter. This part of the subject is illustrated, like the former parts, with tables, showing the results of the author's experiments; and the whole work being actually practical, forms a fund of matter of the greatest importance for reference by the practical and mining engineer, and of which we shall frequently make

ORIGINAL CORRESPONDENCE.

THE CAVERN OF KERRY.

SIR,—The recent tragic catastrophe in the cave lately discovered in the county of Kerry, Ireland, wherein several individuals have fallen martyrs to the "choke damp," or carbonic acid gas, and similar to the accident which occurred to the sinners (for there were two who perished) of Captain Lyon, on the banks of the Nile, has led me to much thought and reflection on the subject, and I am glad I can announce, through the medium of the *Mining Journal*, a safe and successful method of encountering the contingency, and recovering the bodies of the victims of asphyxia, under such circumstances, which may, within certain limits of time, by proper means, be restored. A bandage, saturated with lime water, is worn over the mouth and nostrils; the air by this inhibition is deprived, and the carbonic acid arrested, and neutralized by the caustic lime;—but it is necessary to be more specific. I find coarse "bagging," such as hop sacking, &c., to suit this purpose very well; it will be merely necessary to keep it apart from the mouth by a small frame or mould, such as one of wholebone, reed, or wire. The meshes of the sackcloth must allow free respiration, and yet be as close as compatible with this function—that of coarse muslin or fine wire gauze will suffice. This may be called a *chemico-mechanical filter*; the carbonic acid gas will, in its transit, chemically combine with the "caustic lime" of the lime water, and form a carbonate, and the depurated air supply the requirements of respiration. By having attached by a belt to the person a tin case or can, with lime water, and a sponge to renew from time to time the saturation, an individual may encounter for hours together, without the slightest injury, an atmosphere highly charged with this destructive gas. The tin case should be supplied with a lid, opening freely on a hinge, and closing by its own weight. J. MURRAY.

September 10.

ANTIDOTE FOR ARSENIC.

SIR,—An antidote for arsenic (*arsenious acid*) had long been a desideratum; happily, that interesting discovery has been made these several years past, and yet is far from being generally known. *Hydrous peroxide of iron* is that valuable remedy; and I can safely assure you, from oft-repeated experiments, that this antidote is a *specific*. By referring to the red ochrey deposit connected with the water issuing from a chalybeate spring, you will know what I mean; this substance, under the name of "rubbie," is sometimes used to mark sheep; and what is called *crocus martis* is a peroxide of iron. I have given to one animal what would have destroyed several; but when the hydrous peroxide of iron was administered at the same time, or in a reasonable period afterwards, the poison was perfectly inert. This *remedy* was announced from Germany; but the scepticism with which it was received in this country almost exceeds belief. In cases of poisoning by arsenic, the stomach-pump is of no avail.

I have discovered, moreover, that the hydrous peroxide of iron is also an antidote to *corrosive sublimate*. I prepare this antidote by precipitating the oxide of iron from a solution of sulphate of iron with caustic potassa; the precipitate is easily separated by the filter, and, when washed, and exposed to the atmosphere, it will soon assume its characteristic redness.—*August* 29. J. MURRAY.

FARMER'S PATENT ROTARY PUMP.

SIR,—I have been extremely pleased with this ingenious invention, and admire it at once for its simplicity and efficiency. Having tried it, I can attest the extreme ease with which it is worked, and yields a continuous and copious stream of water. I only wish there had been a size still less than those I have seen, with a corresponding diminution of cost, so as to bring it within the sphere of universal adoption, and thus extend its use.—*Sept.* 2. J. MURRAY.

FREEING THE WIRE GAUZE OF THE SAFETY LAMP FROM OIL.

SIR,—The use of potassa or soda, in a caustic form, is not essential for cleansing the wire gauze of the safety lamp, and freeing it from oil. I have elsewhere recommended lime water for the preservation of the wire gauze from rust, and this caustic lime will also, from its alkaline character, form a saponaceous compound, and thus free the wire gauze entirely from adhering oil. Dip the lamp repeatedly in lime water, and apply the brush.—*Sept.* 9. J. MURRAY.

INDURATION OF LOOSE STONES.

SIR,—Oxide of iron being the cementing principle in the blue lias of Lyme Regis and Aberthaw limestone, as well as in the materials used for "Roman cement," and seeing that nails, machine spikes, &c., become excellent to agglomerated masses of shingle or pebbles, it every years ago occurred to me, that artificial rocks, under the form of breaks or conglomerates, might be contrapted as a defence against the invasion of the sea. Fragments of rock and shingle from the beach might be mingled with pieces of iron and potsherds, sand, clay, and quicklime, and soon become indurated into one solid and concrete mass. I once found on the shores of Yarmouth a mass of solid sandstone, the nucleus of which was a nail, and I have seen a very large piece of conglomerate which had formed round a machine spike. Porphyries and conglobate illustrate what I wish to establish.—*Sept.* 9. J. MURRAY.

A BALLOTINE.

SIR,—The *Journal des Mines*, a short time ago, described a ballotine, or mass of ice, which lately fell in France, from an electric cloud, and weighed about 3 lbs. (14 kilogrammes). Fifteen years have now elapsed since the late Colonel Mark Wilks, author of the *History of the Mysore Country*, and long a resident in India, related to me a singular phenomenon of this kind of his own (Kirby House, Isle of Man), when Anthony Dunlop, Esq., the eldest son of "Mrs. Dunlop, of Dunlop, the representative of the House of Wallace, and the friend of Burns," formed one of the guests at the dinner table. It is necessary to mention particulars in corroboration, and I therefore allude to his name. Colonel Wilks stated that he had been informed by the Rajah of the country, that a huge mass of ice had many years ago fallen in a particular district of his dominions as large as an elephant. Colonel Wilks further informed me, that he went to the locality, and examined a great number of independent witnesses, and strictest evidence which fully confirmed the fact, that a mass of ice of enormous magnitude had certainly fallen there. It was described to have been as large as an elephant, clear as glass, burst their fingers when touched, and, after remaining some time, melted away, exhaling a florid smell. Colonel Wilks said to me:—"I do not desire you should believe it, but the testimony I collected carries conviction to my own mind, and I must believe it"—and reason, some ultimate must be made for Oriental fancy in reference to a phenomenon altogether unique. J. MURRAY.

September 7.

INCROSTATION.

SIR,—It is stated in the *Times Standard*, that a fold of cord to the extent of two and a half acres was lately consumed, and as the railway train has just passed at the moment to hinder me, the fire was attributed—and naturally reasonably so—to a fire cast from the locomotive engine. You will remember I had especially cited this as one extreme cause of danger. I have seen patches of hemp and coal of gauze on the embankments kindled by fire-coals dropped from the bars below, and blown away by the wind, and seen behind over the embankments; others have seen the embankment in a blaze by a very considerable extent. A wire gauze cradle should confine the burning cinders which fall from the bars, and the slip bottom flush-pan to withdraw from time to time into troughs which are provided for the purpose on the railway train. Nothing can be more dangerous to high winds than the present arrangements. J. MURRAY.

September 5.

ON GILDING.

SIR,—I have elsewhere recorded my decided opposition to heating specimens by stoves and plates, and especially when the fires are at once. Heating can maintain the palubity of the atmosphere—it is the greatest boon to a healthy atmosphere. It is a fierce tornado which carries off the will fires, and when they accompany subsequently, there will be a continued succession of the accompanying and the deleterious products are continued by the stoves. In the case of heating by pipes of fire, we have no fires at all. By iron stoves with flues, the natural and vegetable matters floating in the atmosphere are decomposed, and even the hydrogen is evaporated, the oxygen being retained and fixed, while oxygen, hydrogen evolved, perhaps with minute quantities of sulphuretted and arsenuretted hydrogen, with the air so invested of its oxygen principle. Can we, then, wonder at the apparent and weird effects of under such circumstances, or that in such an atmosphere continued indigestion should be experienced? The hopes on which records from the iron cradle is liable to the same danger of insufficiency. Those men, and evils of proportionate, will soon serve as a cautionary to an article in your last.

September 7. J. MURRAY.

ON GILDING.

SIR,—The process of gilding by the solution of gold in *aqua regia* is of olden date; silver promptly takes up gold from its chloride in solution, and may be thus employed to gild insects, needles, &c. Highly rectified sulphuric ether must be here understood. A patent was, some years ago, applied for, for the process of gilding, but it could not be sustained, it being shown that even John Glauber was no stranger to it, and that it was known in his day under the name "potable gold." It had been long known to chemists that solid phosphorus would reduce platinum, gold, silver, mercury, copper, &c., from their acid compounds in solution, but the most elegant application of phosphorus to gilding, &c., is that now employed with such eminent success. The article to be gilded is simply dipped into a solution of phosphorus in sulphuret of carbon, and then into the *aurifluous* solution. A small portion of phosphorus will suffice, and as the solution is extremely inflammable, the greatest caution is requisite—indeed, I have for many years been in the habit of using it for detecting minute increments of temperature.—*Sept.* 10. J. MURRAY.

THE BATH WATERS.

SIR,—If I were asked to what leading principles Great Britain owes her commercial pre-eminence, I should answer, without hesitation, to those of mechanics and chemistry. Every Englishmen fancies himself born a mechanic, and, therefore, as the nation is essentially practical in its ideas, that science is preserved in all its practical vigour. But it is only a few favoured individuals who claim to be enrolled as Nature's chemists, or as her adopted and favoured disciples. The consequence is, that chemistry, being less under popular auspices, is more of a speculative, or abstractedly experimental, science, and but now and then stoops to practical purposes; and yet how frequently might this science throw light on the mind, and afford cheerful and instructive employment for the understanding, not of a few, but of large bodies of the thinking classes; and to think, when the mind has been accustomed to exercise itself, is to live—not to think, is almost to die. I will mention an instance—the particular one, which has indeed me to write this note—in which the familiar aid of chemistry would become instructive and entertaining to many. I will go further, and say, it might not improbably contribute to their restoration to health, for when remedies really are powerful, a knowledge of their power is encouraging to those who have recourse to them. I now allude to the Bath waters. In what do their virtues consist? There are different stories about them here—many and various—and, therefore, I do not concern myself much about any of them; but I should like to induce some able chemist to give us a scientific and practical account of them. How could Dr. Murray better employ a leisure hour? It seems to me his delight to afford valuable information to the public, and to render his studies and the labours of his life conducive to the public good. I hope he will take the hint.

There are many points on which information would be most interesting. How is it that these waters have now, as it is known, risen in a powerful, continued stream, from the bowels of the earth, for nearly 2000 years, at a temperature of 116°—for they were known, and their virtues were duly appreciated, by the Romans? Long before their arrival in Britain, too, it can scarcely be doubted the Bath waters were gushing up their salubrious streams. How is it that those limpid and nearly tasteless waters, if drunk immoderately, and "without the patient being prepared," are said to produce a lightness in the head, that would look very suspicious in a person who had taken the pledge? How is it, that, though remarkably pellucid at first, they become dimmed, or milky as it is termed, shortly after they have reached the surface, and attained a state of quietude? What are those bubbles that rise profusely with the water, and what are their properties? I have been told they are, and are not, hydrogen—of their medical proportion, if any, I have heard nothing. How is it, that, if you take a bath at blood heat, and remain in the water from ten minutes to a quarter of an hour, you find rheumatic pains—if not very severe—insufferable, and "half the ills that man is heir to," vanish, and perceive yourself in possession of a kind of artificial health, elastic, but not strong; but, if you remain in a little longer, debility is found to be increased, and a feeling of thorough wretchedness to pervade the whole system? And how is it that weather and season appear not to affect these mysterious springs?

I trust Dr. Murray will excuse my inquisitiveness, prompted, as it is, by the ability he so frequently exhibits in your valuable columns, and I can assure him he will delight many of the "Bathonians," and the visitors at the present city, if he will put them in possession of a popular account of the chemical and medical properties of the Bath waters, and none will be greatly more than. AN INVALID.

Bath, September 10.

STEAM BOILER EXPLOSIONS.

SIR,—I observe in your Journal of the 24th ult., which contains my suggestions on steam-boiler explosions and safety-valves, the following announcement:—"Great damage was occasioned at the coal works of Hunt Fleuri by the bursting of one of the boilers of the engine used in clearing the mine of water; several men were killed, and others much injured." This, however, is but the last item in the fearful catalogue of such frightful accidents. It is the duty of men of science to attend to the small as well as to the great, for it is the touchstone of the common and the steam valve, as well as the fire, that do the duty. Your able correspondents have well written of the neglect of our truly great men, but there are also lesser lights in private paths as little patronised by wealthy neighbours as men of science by our Government. Now, Sir, there is a little improvement on the safety-valve suggested last week, which now occurs to me. Let three pipes of about two inches diameter project upwards from the top of the boiler, one at each side or thereabouts, and one from the central part of the boiler—the edge of the pipe to be tapered to a mere line, and a plate of brass or brass and leather be made to fit it close at top, with side guides (say, three or four); and a vertical rod for weights, with holes in them as before, and pointed by a cotter-ring, as already suggested. It is not impossible, that, in addition to the other causes mentioned in my last, hydraulic pressure may have something to do with the bursting of boilers, especially when the water is not as equanimal as that so injected, whilst the safety-valve and its rise may, in all instants and purposes, be one solid piece of metal.

Penzance, August 17. ALFRED T. J. MARTIN.

P.S.—Adverting to my former communications, and Dr. Murray's letter on this subject, allow me to remark, that one would have thought that the advanced state of science would have rendered safety from steam-boiler explosions a mechanical certainty. That this, however, is not yet arrived at, the repeated and unexpected accidents on both sides the Atlantic but too clearly demonstrate, and even your last paper contains another proof. The Americans, who were the first to "go a-head" with their steam-boats, not only sap their worm-breaking lakes and rice-rising rivers, but up and down their rapids, have not, with all their Fulton's—nor we, with our Watt's, Trevithick's, and modern Watt's—learnt how to prevent the bursting of a boiler under all circumstances. A recent instance of explosion in the Severn has just come to my knowledge, by which several persons were scalded to death, and others with affrighted faces swam to the shore. In addition to the steam heretofore hinted at, may be superinduced a deficiency of water, and consequent overheating of the latter plates. Whatever the causes, however, we are continually reminded of the old adage, that prevention is better than cure. Attention to small matters was not always (nor is it invariably now) deemed beneath the dignity of the philosopher. Watt was not ashamed to turn down silver to copper (the latter to be dissolved by nitric acid) for his telescopes! Other capitalists imitate Captain Warner's downed apparatus from chemists and watchmakers, and many from Gunpowderists who have yet to learn that "it is better to save life than to kill." As to steam boilers, it is quite evident that a new kind of valve is wanted, as well as other desiderata to which attention is invited.—*Sept.* 9. A. T. J. M.

(The continuation of original Correspondence, see p. 320.)

NEW MODE OF VARNISHING METALLIC SURFACES.—A new art, for the ornamenting of the surfaces of metals in metal, has lately been proposed in Bourgogne, and a long account of it presented by him to the Academy of Sciences of Rouen, to which is added all the principles and instructions necessary for the completion of the art. It consists in the production of metallic oxides or carbonates of great beauty upon metallic surfaces, by the presentation upon them of an indefinite thin coat of paraffin or bees, by the aid of particular arrangements. A successful selection of paraffin of bees is to result in certain points of a certain degree of fusibility, and from this the peculiar of bees is dependent upon the positive gain of a galvanic arrangement of a few pairs of plates. The oxides are produced in connexion with hydrogen rings, the other specially selected, and known as Newton's rings; and, by stopping out any desirable portions of the surface, in form of arabesque or other designs, combinations of great beauty may be effected. The only difficulty appears to be, that the oxides are sometimes easily detached by friction; but this may probably be remedied by heating and tempering. The process seems worthy the attention of some of the Birmingham manufacturers.

TERRESTRIAL ELECTRICITY.

In the *Polytechnic Review* for July is an article by Mr. J. J. Lake, in which he endeavours to prove, by a detail of various circumstances which occurred on the morning of the great earthquake of Lisbon (Nov. 1, 1755), that, instead of electricity having nothing to do with such phenomena, earthquakes are in general the results of, or closely connected with, that powerful agent.—For the four years preceding 1755, there appears to have been a disturbance of the usual passage of the electrical fluid; the state of many strata was also altered by a great drought that prevailed, and the year 1755 was very wet; thus, some strata being more porous, and consequently absorbing more wet, than others, would have their conducting powers renewed the soonest. This circumstance, if electric fluid had gathered, would accelerate, and even produce, shocks of earthquake.

The day previous to the fatal event, the presence of the fluid was noted at Lisbon, by a gloominess that prevailed in the atmosphere, which obscured the sun. At Colares, a fog came over the sea, which rose with tremendous roaring. The 1st of November began with a thick fog, which the sun soon dissipated; the weather was warm, not a breath of wind stirred, and the sea was perfectly quiet. It was in the midst of this deceitful calm that the catastrophe began. The shocks at Lisbon were felt rather later than at Colares; the first raised up the earth, as would be the case in a subterranean electric discharge, which is proved by the bar being laid bare from shore to shore, the bed of the Tagus rising in many places above its surface, and the retiring of the sea. When the earth fell again, the sea returned, rolling like a mountain; by the impetus it had received, rushed inland, and rose fifty feet at Belem Castle. The shocks were at first short, and in quick succession, as if through a series of insulated conductors, producing a noise like the rattling of chariots, which increased until it equalled the roar of cannon. Among a variety of curious phenomena, Capt. Clark, from Deina, in lat. 36° 24' north, had his ship strained and shaken as if she had struck on a rock, the seams of the deck opened, and the compass was overturned. The master of a vessel bound to America, in lat. 25° north, long. 43° west, was writing in his cabin, when he heard a violent noise, and the ship was jerked in a strange manner; in looking out he saw land at about a mile distance, but by the time he got on deck it was no more to be seen. A violent current passed the ship to leeward, which shortly returned with great impetuosity, and about a league off he saw three craggy pointed rocks throwing up water of various colours resembling fire; this curious phenomenon ended in a black cloud, which ascended heavily. Another ship, forty leagues from St. Vincent, was so strongly agitated, that the anchors, which were lashed, bounced up, and the men were thrown a foot and a half perpendicular from the deck; the lead showed a great depth of water; the line was tinged a yellow colour, and smelt of sulphur. Although the shocks were felt in Great Britain, Sweden, Norway, Germany, Holland, France, the Peninsula, Italy, Switzerland, Antigua, Barbadoes, and other parts of the world, some smoke which ascended from the hill Fojo, near Colares, was the only appearance at all of volcanic eruption; the appearances in the water resembling fire, were, no doubt, occasioned by electrical excitation, produced by the passage of rocks through water. From the peculiar direction of the electric currents, and the general phenomenon observed at the time of the earthquake, the author concludes, that wherever volcanic agency appeared, it arose from the combustion of sulphur, and other inflammable materials by the electric discharge; had it been produced by subterranean fire, lava, pumice stone, &c., would have been found, particularly at Fojo, or floating at sea. Nothing of the kind was, however, seen, though the shocks were felt from Norway to Madeira, and from the West Indies to Italy.

GEOLOGICAL DISCOVERY AT PONTYPOOL.

A highly interesting geological discovery has been lately made at the Pentwyn Iron-Works, near Pontypool. While the workmen engaged in one of the mine levels were proceeding with their operations, they encountered a fossil tree of considerable size; and the attention of Mr. Cadman, the intelligent mining agent of those works, having been called to it, he directed every exertion to be made for its preservation. The surrounding material was consequently removed with the utmost care, and every part of the fossil having thus been preserved from injury, its structure was most clearly developed. The stratum in which it was embedded is a fine siliceous shale, containing iron ore, and forming a moderate angle of inclination with the horizon. The tree was in an erect position, and perpendicular to the plane of stratification; a thin coating of coal, apparently the carbonized bark, enveloped it, which could be readily scraped off with the nail, and was so friable as to render it impossible to discern the character of the external markings; the internal coal, however, partook of the same nature as the surrounding stratum, and beneath the coaly covering there were evident indications of foliage, or longitudinal strie, the appearance of which was very similar to that presented by decorticated trunks of recent forest trees; the base of the trunk thickened out considerably, and large spreading roots projected on every side; the circumference at the base immediately above the point of junction with the roots is six feet, and from thence it diminishes to four feet, in a height of about five feet, beyond which it has not yet been followed. We are decidedly of opinion, that this tree grew on the precise spot where it is now found; and this view is supported, not only by the important fact of its erect position, but also by the state of the roots, which are quite conformable to the inclination of the stratum in which they repose, and extend downwards a considerable length—whereas, if the tree had been drifted from a distance, and deposited in its present situation, we are inclined to think, that its weight would in such case have kept the roots to an up-and direction.

We consider this specimen to be a variety of the *Sigillaria*, of which about forty species have been discovered in the coal measures. This plant has been classified by Sternberg, Lindley, and others, and, we think, been satisfactorily shown by the late Mr. Sowerby, and others, that it belongs to the *Dicotyledonous* division; the contrary view is, however, held in almost all geological works—and, indeed, one of the highest authorities on fossil botany, M. Adolphe Brongniart, in his *Prodrome d'une Histoire des Végétaux Fossiles*, states, that the *Sigillariæ* do not appear until so recently as the tertiary epoch. But, although we may certainly be in error as to the species, we feel perfectly assured of the correctness of the view which we have taken of the genus of the plant under consideration—the thickening of the base, the markings of the trunk, with the evident appearance of a thin bark, and, above all, the massive character and position of the roots, are certainly satisfactory evidences of *Sigillarioidean* structure.

In one of the cuttings of the Bolton and Manchester Railway, about three or four years since, several trees of a similar kind were discovered, and recorded the highest interest in the scientific world; they were all erect, having their roots spread out, and reposing on a small seam of coal. About the same period, several others were discovered in forming the Clay-cross Railway Tunnel, near Chesterfield; these being likewise in an erect position, and disposed at right angles with the plane of stratification. These discoveries, in connexion with the investigations of Mr. Logan in the South Wales coal field, have created considerable influence over the views of geologists respecting the formation of coal, and have induced many of the most eminent, including Dr. Buckland, to abandon the theories which they previously advocated. That coal is of vegetable origin—that it is, in fact, the vegetation of the primeval earth, converted by heat and pressure into a mineral substance—is now universally admitted; though geologists are not yet agreed as to the mode of its deposit. The most popular hypothesis has been, that the luxuriant forests of an ultra-tropical climate had been swept by torrents and inundations, peculiar to such a state of the earth, into lakes, estuaries, or seas, and, being there covered by successive deposits of mud, sand, or clay, which after wards hardened into rock or shale, the vegetable matter, having the lapse of countless ages, become elaborated into beds of coal. This was the prevailing idea, until the discovery before alluded to in the coal measures, of trees similar to that we have endeavoured to describe, in an erect position, and bearing every appearance of having grown and been embedded on the spot where they are now discovered; and about the same time, Mr. Logan also directed attention to the fact, that in the South Wales coal-field there invariably occurs under every seam of coal a seemingly of clay, varying in thickness from a few inches to several feet, and containing in profusion the mineralized remains of the *Stigmaria ficoides*, which seems to have been a large cannulated water plant. Similar phenomena have also been noticed in the same situation throughout the coal fields of Pennsylvania. Our limits will not permit us to enter into the particulars of the said discovery, but it may be briefly stated, that the latest geological facts, in connexion with other observations, have induced several of our most eminent geologists to abandon the theory of the formation of coal by drift, and to adopt that which assumes the superficial surface to have grown and flourished on the precise spot which it now occupies, and where it has been subsequently covered by submergence, and a course of deposit (*Magazine of Natural History*, from mineral coal.—[W. L., Pontypool; *Monmouthshire Merlin*.])

ANEMOMETER VAN MOURIK.—Dr. Galloway's various evolutions, executed by one of the principal gas companies, will give a new idea of the system of private gas works, commencing by twelve companies; their applied amounts to upwards of 3,000,000*l*., employed in pipes, tanks, &c. The revenue I consider therefore is estimated at 600,000*l*., per annum. There are about 100,000 tons of coals used annually; there are 2,000,000 cubic feet of gas used; 100,000 gallons liquor, 30,000 gallons liquor; 500 lamplighters; 700 gasometers, several of three stories, and capacities varying 1,000,000 cubic; and about 1000 persons are employed in various ways.

THE INDUSTRIAL RESOURCES OF IRELAND.

A volume under the above title has just issued from the press, which, from the statistical information it contains, affecting the industrial progress of Ireland, a detailed examination into the sources of manufactures, and the situations of the original materials for their support, is likely to do much good for that country. The author is Dr. Kane, a gentleman whose opportunities to correct the ideas usually entertained of the disadvantages under which Ireland naturally labours with regard to mechanical industry have been great, and who, in the work before us, clearly shows that she has within her the germs of a wealthy and prosperous country—stores of fuel, iron, and other ores in abundance—water power for machinery, and navigable rivers to a great extent, with a soil naturally fertile; these she possesses to an extent equal to any country on earth, and it wants but the development of these resources, the introduction of capital, to rouse the industry of her natives, and raise her to the eminence she deserves. We now give a lengthened abstract of the work, to place the principal portion of the author's views and investigations before our readers.

The first chapter treats on the importance of fuel in the industrial arts, and the circumstances of Ireland as to fuel. Dr. Kane says that country was, some centuries ago, as remarkable for its extent of forests as it is now the reverse, and many causes conspired for their destruction; in some districts they were extirpated to increase the arable surface, in others in order to destroy the shelter which bands of outlaws found in their recesses. An extensive export trade in oak was at one time carried on, and two centuries ago the manufacture of iron was in great activity throughout the country, and led to the cutting down of innumerable trees, in order to prepare charcoal; during all this time no one planted—all sought for immediate profit, and cared not for the future, and the final result has been, that at present the timber grown in Ireland is not sufficient for use, and, as a fuel, it may be considered that it can never again be employed. After a general description of the formation of coal, and the strata in which it is generally found, he proceeds to give an account of the several coal deposits of Ireland; they consist of a series of sandstone and slaty rocks, resting upon the upper limestone, and give an aspect of considerable elevation to the district; these are seven of them—one in Leinster, two in Munster, three in Ulster, and one in Connaught; those to the north of Dublin yield bituminous or flaming coal, while those to the south yield only anthracite. The Leinster deposit occupies the greater portion of the county of Kilkenny, Queen's County, and part of Carlow, being bounded by the two great rivers Barrow and Nore, which run immediately at the base of the Colling Hills; its general appearance from a distance is a ridge of high land, running in a direct line for many miles, rising 800 or 1000 feet above its base, and apparently flat on the summit, but, when viewed from the eminence itself, it resembles a great barren table land, rising precipitously above a flat and highly cultivated country. The strata consists of beds of slate clay, containing thin veins and nodules of ironstone, compact sandstone, and sandstone slate, beds of fire clay, and eight workable coal beds, consisting of coal, keive, and slate of ten feet, of which four feet are coal; in this field it is calculated there are 63,000,000 tons of pure solid coal, ranging at a depth of from 106 to 140 yards beneath the surface; the quantity raised is estimated at 120,000 tons per annum, and sold at a price of 11s. 6d. per ton. The Tipperary coal-field extends about twenty miles in length, by six in its widest part; it forms a range of hills of from 300 to 600 feet in height; the general nature and arrangement of the strata are the same as before-mentioned, but they dip at a steeper angle, and undulate—hence, a peculiar mode of working; the coal lying in deep troughs, the shaft is sunk in the centre, and the coal wrought by working on each side of it. Farther to the south and west we arrive at the Munster coal-field; this tract, the most extensive development of the coal strata in the kingdom, occupies considerable portions of the counties of Clare, Limerick, Cork, and Kerry. The physical features of the country are like those of Tipperary; the coal lying in a series of troughs, the hills striking from west to east, and the strata dipping on either side north and south; all these are the non-flaming or anthracite coal. We now pass to the bituminous; a small but interesting bed occurs in Tyrone; the country round it resembles a great geological museum, containing rocks of every epoch, from the granite rising from beneath all, to those tertiary clays which constitute the latest of the geological series. The limestone of Dungannon may be considered as forming the base of the Tyrone coal district, covered by sandstone, limestone, and slate clay, with clay, ironstone, fire clay, and coal. The coal burns rapidly with flame, and evolves great heat, is not difficult to raise, and its quantity is such as to be capable of diffusing the blessings of industrial prosperity over an extensive area. From twenty-two to thirty-two feet of solid workable coal is here found within a depth of 120 fathoms, no example equal to which is to be found in all the English mines. At the northern extremity of Antrim is a coal district, unimportant as to magnitude, but remarkable from its association with the great basaltic mass, from which the characteristic scenery of Fairhead and the Causeway is derived. This coal-field differs from all others in this country, by wanting the underlying limestone, and resting direct on the mica slate; this rare peculiarity has one parallel—viz., the coal beds of St. Etienne, in France. At Mulragh Bay the beds of coal are six in number—four bituminous, and two anthracite; the latter are found one immediately above, and the other close below, a range of columnar basalt, of seventy feet in thickness, which lies in amongst the coal strata. The quantity of coal remaining is so small, as to render further detail unnecessary; it appears to be the oldest worked colliery in Ireland, perhaps in the empire. During the year 1770 the miners broke into an old gallery, the walls of which were lined with stalactites, evidently of great age, and ancient mining tools found therein; the residents of the district had never heard of a tradition of the mine having been anciently worked, and the excavation must have been made at a very remote period. The coal-fields of the Connaught district are worthy attention, from their peculiar geographical position, and from the attempt by the Arigna Company to establish the iron manufacture within its bounds. The hills which surround Lough Allen form the Connaught coal-field, and occupy large parts of the counties of Roscommon, Sligo, Leitrim, and a portion of Cavan and Ulster; the greatest length is sixteen miles, and it is about the same in breadth—the total area being about 114,000 Irish acres; they present a steep and straight ridge of from 1000 to 1200 feet in height, the summits flat, and usually covered with bog. The rocks are similar to those of the other coal-fields. West of Lough Allen the river Arigna divides the field into the southern and western portions, the former consisting of one great mountain ridge, called Braulieve; at its base are the Arigna Iron Works. The western division extends between the Arigna and Doonbally ranges, the two portions having the same internal structure. Upon the limestone rests clay slate, from 300 to 600 feet in thickness, remarkable for the rich beds of ironstone it contains, which are exposed in the channel of the river Arigna in incredible numbers; this district contains three beds of coal—the first varies from one to three feet in thickness, the second from three feet to three and a half feet, and the last is about nine inches thick; the second bed, or three feet coal, is considered the best in the empire for smelting iron. Above [illegible]

[illegible]

of Ireland, and which would be of immense advantage, were it not usually spoiled in the preparation. The total area of Ireland is 20,000,000 acres; the total area of bog 2,830,000 acres—a seventh of the entire island. Turf contains much less nitrogen than coal—hence the liquor obtained in distilling turf contains no free ammonia, and its calorific power is about half that of coal; there is nothing in the industrial economy of Ireland which requires more attention than the collection and preparation of turf; for useful practical purposes it is absolutely spoiled; it is cut in a wet season, and, while drying, is exposed to the weather, and hence is not dried at all; 1 lb. of pure dry turf will evaporate 6 lbs. of water, while 1 lb. of turf, as generally used, contains ¾ lb. of turf, and ¼ lb. of water—consequently, its evaporative powers are inferior to the dry by more than 25 per cent., and all that is required is to dry it under cover, when it will still retain one tenth its weight of water; further evaporation is too expensive and tedious, except in some especial cases. Many attempts have been made to get rid of the porosity and elasticity of turf, but the plan which promises to be of the greatest utility is that by Mr. C. W. Williams, which consists in drying the turf well, and then impregnating it with tar, which renders it waterproof as it were, besides augmenting its calorific power; turf so prepared has no tendency to re-absorb moisture, which is the serious failing of turf that has been imperfectly dried, and the expense of thus bituminising the turf is trifling; it is said turf thus prepared can be manufactured for from 6s. to 8s. per ton, and from the trials already made, it appears to have a calorific power little inferior to coal. The employment of turf as a fuel is extending; already it supplies exclusively the steam-boats on the Shannon, and a great number of distilleries and mills. Such is an outline of the author's description of the sources of fuel in Ireland, and as all its application depends on its cost, the amount and consequences of the cost of fuel in Ireland forms the subject of the succeeding chapter.

The author next proceeds to consider the evaporative power of different coals, and the practical results of the use of turf in steamers and fixed engines, with the influence of the cost of fuel on the final cost of the products of manufacture. He states, that misconceptions of very varied but serious character are entertained of the degree in which the price of fuel influences the industrial arts; and proceeds to illustrate the mode in which the greatest economy can be secured on its application. The following, in pounds, is the quantity of water which 1 lb. of the following substances will evaporate—viz.: hydrogen, 46·0; pure charcoal, or carbon, 14·6; coke, 13·0; turf coke, 12·0; coal, on the average, 12·0; turf (best), 6·0; dry wood, 7·0; wood not dried, 5·2. The cost of coals per ton from the coal fields of Ireland he gives as follows—viz.: Leinster, large coal 11s. 6d., small coal 4s.; Tipperary, large 12s., small 4s.; Tyrone, large 12s., small 3s.; Connaught, large 6s.;—and, a mixture of large and small being convenient for generating heat, he calculates the average cost at 12s. per ton, including carriage; and, as the horse power of steam is generated by the combustion of 10 lbs. of coal per hour, the cost of fuel for steam-power, at an average distance of twenty miles from the pits, may be taken at 7½d. per horse-power per day. In the working of a condensing engine of 34 horse power, in one of the central counties, and in the furnace of which turf is burned, there were consumed fifty boxes of 200 lbs. each in twelve hours, or 34 lbs. of turf per horse-power per hour, giving a cost of 6d. per horse-power per day. In one experiment made between average Cardiff coals and turf, it was found that 1 lb. of coal raised 365,594 lbs. of water one foot high, 1 lb. of turf only 121,480 lbs.—hence the effect of turf appears to be only one-third that of coal; but in some districts experiment has proved that the cost is greatly in favour of turf—three cubic feet of the latter, cost 8½d., doing the same work as 310 lbs. of coals, which cost 17d., or just double the expense. In the working of the *Lansdowne*, one of the steamers of the Inland Navigation Company, and plying on the Shannon, the average cost of coals was 7s. 3d. per hour; but, on the introduction of turf, and which is now solely burned, the same work is performed for 3s. 11d. per hour, or a shade more than half the cost of coal—the saving to the company on this steam-boat alone is 600*l.* a year. From all the examples adduced, it appears, the average of horse-power per day in Ireland of steam-power costs—by coals, British or native, 7½d.; turf, properly dried, 6d.; C. W. Williams's prepared turf, 5½d.

The author, in the next chapter, proceeds to the consideration of the amount of water power in Ireland, the amount of rain and evaporation, and the total mechanical force generated, both in the rivers and the lakes. The moisture of the air in Ireland is much greater than in England; and, from the observations of various parties, it appears, that the quantity of rain which fell on an average of six years, in Dublin, was 30·87 inches; Belfast, six years, 34·36 inches; Castle Comer, eighteen years, 37·80 inches; Cork, six years, 40·20 inches; and Derry, seven years, 31·12 inches;—hence, Dublin is the dryest, and Cork the wettest, of any places where observations have been made. If all the rain that falls on the surface of Ireland in a year were collected, it would cover the island to the depth of thirty-six inches; and, its area being 100,712,631,640 square yards, there are that number of cubic yards of water precipitated on its surface every year. He estimates, allowing for evaporation and other circumstances, that one third of this flows to the sea; and, as 884 tons of water falling twenty-four feet in twenty-four hours is equal to 1 horse power, there is a total water power distributed over the surface of Ireland of 1,412,130 horse power—or, reduced to 300 working days of twelve hours each, gives the amount of horse-power three millions and a half; and although a great portion of this must be unavailable, and a certain decrease must be calculated for the loss of power in the various machines, still it is evident that Ireland has an amount of mechanical force from this source sufficient to develope her industry to an enormous extent.

Having taken a review of the various advantages attendant on the use of the over shot, the breast, the under-shot, and Poncelet wheels, with Barker's mill and the turbine, the author proceeds to the importance of iron in the arts, its ancient manufacture in Ireland, refining with turf, and its superior quality, &c. The increase in the value bestowed by labour on iron is enormous, as will be seen by the following statements:—1*l.* worth of cast iron, when converted into ordinary machinery, becomes worth 4*l.*; larger ornamental work, 45*l.*; buckles and Berlin work, 600*l.*; neck-chains, 1386*l.*; shirt buttons, 5896*l.* 1*l.* worth of bar iron, converted into horse-shoes, becomes worth 2*l.* 10s.; table knives, 36*l.*; needles, 71*l.*; pen-knife blades, 657*l.*; polished buttons and buckles, 897*l.*; balance-springs of watches, 50,000*l.*—Centuries ago, Ireland presented a picture of manufacturing industry which she does not possess at present; covered with forests, and possessing iron ore of the highest quality in great abundance, the island was sprinkled over with small iron works, in which charcoal was employed, and iron manufactured of an excellent quality, equal to what is now imported from Sweden and Russia, for cutlery and steel-making; and so prolific was this trade, that so late as the 17th century Sir Chas. Coote, from his iron works in Queen's County, and the Earl of Cork, from those in Munster, continually manufactured and transported iron to the London market. The vast quantity of wood consumed, however, began gradually to strip Ireland of her forests, and for want of charcoal the iron manufacture rapidly declined; and about 100 years ago, in Kerry, the last charcoal [illegible]

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into Derry and Tyrone, disappears under the sandstone formation. The clay slate is one of the most important rocks of Ireland, as well from the area over which it extends, as from the quantity of minerals it contains; resting on this occur a number of rocks, occupying a large portion of the country, usually siliceous, the grain varying from the finest sand to large pebbles. The old red sandstone is most extensively developed in the south of Ireland, forming the greater part of the county of Cork, and stretching northward almost to the foot of the Wexford granitic ridge. In Tyrone, another large field of this stone appears, about twenty miles long, with a breadth of six miles; while scattered around, and several miles from it, are numerous patches of the same formation. The new red sandstone, which in England is of such importance, from its deposits of gypsum and rock salt, is in Ireland of very limited extent; and the igneous rocks are found almost alone in the county of Antrim, and from their decomposition produce ochres and clays of various and beautiful colours, in extensive beds. Such are the general characters of the geological structure of Ireland.

With respect to her mineral resources, her copper mines may be said to form three groups—one in the county of Wicklow, another in Waterford, and the third in Cork and Kerry. The ores produced are, the malachite, or green carbonate, yielding 57·7 per cent. of copper; the blue carbonate, or azurite, yielding 55·5 per cent.; the grey ore, or sub-sulphuret, is found very abundantly, and is the most valuable of the ores, containing 80 per cent. of copper, and 20 per cent. of sulphur; and the ordinary yellow copper ore, or copper pyrites, containing, sulphur 34·78, copper 34·78, iron 30·44, in 100 parts. The principal copper mines are—Ballymurtagh, Connorree, Cronebane, Tigroney, Ballygahan, and Allihies. Veins of lead have been worked at Dalkey, Killiney, Ballycorus, Powerscourt, Djouce, Lough Bray, Lough Dan, Glenasane, Glendalough, Glenmalur, Shillelagh. The ores consist of galena, or the sulphuret, containing, lead 86·6, sulphur 13·4; the carbonate, consisting, of lead 77·6, oxygen 6·0, carbonic acid 16·4; and the sulphate, containing, lead 68·4, oxygen 5·3, sulphuric acid 26·3. The two latter may, however, be considered as only accidental, the ore for which a mine is worked being always galena. The average produce of silver extracted from the lead ores of the mines worked by the Mining Company of Ireland, during the year 1843, was 7¾ oz. to the ton of lead—the total quantity being 4261 oz., which realised 1137*l.* 10s. 8d.

The gold deposits discovered towards the close of the last century, in the bed of the streams descending from the northern flank of Croghan Kinshela, on the confines of Wicklow and Wexford, at the junction of the granitic ridge with the clay slate, are next noticed. Considerable quantities were collected by the country people; one piece weighed 22 oz., another 18 oz., others 9 oz. and 7 oz., down to the smallest grain, and it is supposed 10,000*l.* worth was sold before the subject was taken up by the Government, who prosecuted its extraction under the management of Mr. Weaver and others, and, in two years, collected 945 oz., value 3675*l.*, but the cost of the works vastly exceeding the returns the works were discontinued. It was hoped that, by tracing the rivulets to their sources, and laying bare the underlying rocks, the veins might be discovered, from the disintegration of which the sand and soil of the bed of the streams had been produced; all such trials proved fruitless, and the question as to the source of this gold still remains unanswered. Native silver has been found in a vein of iron ochre in Cronebane, but long since exhausted; oxide of manganese occurs in several localities; antimony is found in Clare and Armagh; and a large deposit of the arseniuret of cobalt was found in a copper mine on the lake of Killarney, but was thrown away as useless. One miner, of more practical knowledge than the rest, managed to get away twenty tons of this valuable mineral as rubbish. The immense beds of the bisulphuret of iron, with which the copper lodes in the county of Wicklow are associated, enabled a vast supply of sulphur and sulphuric acid to be obtained from this source, when the Government of Naples placed an exorbitant price on that article, hitherto obtained only from the volcanic districts of Sicily; the mines which produce this pyrites in the greatest abundance are those of Ballymurtagh, Tigroney, Cronebane, and Connoree, all containing the great sulphur course, which traverses them in a north east and south-west direction, and the quantity annually exported for the manufacture of sulphur and its acids is considered to have reached 100,000 tons per annum. The number of persons employed in this mining district is about 2000, and from 340 to 1000 carts are daily employed in bringing the ores to Arklow for exportation. To show how easy, and to what extent, the manufacture of alum might be carried on in Ireland, the author informs us that a formation of true alum slate presents itself on the western coast of Ireland more extensive than that in Yorkshire; this slate forms the upper layers of the great Munster coal formation; its section, presented to the Atlantic for a distance of forty miles, from Ballyvaughan, in Clare, to Ballybunnion, in Kerry, offers a series of frowning precipices and deep caverns; along this coast the pyrites, with which the shale abound, produce by gradual oxidisement copperas, and by its action on the material of the rock native alum. This material might, therefore, be extensively and economically manufactured here. Turf is plentiful, and the Shannon, which intersects the district, affords the most favourable means of access to different markets. Clays in great variety, and numerous building stones and marbles, are found in Ireland under favourable circumstances.

Having considered the agricultural industry of Ireland, the natural fertility of its soil, composition of plants, and action of various manures, with the immense importance of the linen trade, and the cultivation of flax, particularly in the north of Ireland, the author then treats on the internal communication, by navigable rivers, railways, and common roads. He here remarks:—"It is not enough that a country may possess, in the fertility of its soil, or the richness of its mines, the materials for the creation of industrial wealth, but there must also be the means of bringing these resources into play by land and water communication. By their aid, the different substances necessary to manufacture are brought to the localities where the processes to which they are to be subjected can be carried on to the best advantage, and the produce conveyed to situations where its sale may be effected with most profit to its owner. Direct and safe modes of conveyance are, therefore, indispensable to the development of industrial pursuits, as well for the procuring access to raw materials, as to secure markets for the manufactured goods. The isolation in which man is condemned to live in a district destitute of roads, or where transport is difficult or expensive, is fatal to his progress in civilisation and humanity. He grows up in ignorance of his fellow men, his mind limited to the circle of a few ideas— [illegible] looks upon all deviation from them as fraught with injury and ruin. The results of new methods in the management of land or labour, which, within a few miles, are actually producing the greatest benefits, remain utterly unknown to him, and he resists the introduction of all novelties calculated to break through the miserable monotony in which his forefathers and himself have vegetated." The consequences of not having roads is well illustrated in the evidence of Mr. Fetherston, in describing some bog improvements before a committee of the House of Commons. He says:—"The oats these lands grow are so very fine, and of such a rich gold colour, that if we can possibly get them down to the lowlands, we sell them freely for seed oats, but the roads being so bad, we put it to the gene[illegible]

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of common roads in Pebble O'Keefe's country, on the limits of Cork, Limerick, and Kerry, which had been a place of refuge for malefactors and desperadoes of all kinds, caused cottages and farm houses to spring into existence along their sides, and cultivation to extend from their edges into the waste, what will not be the effect upon the industry of Ireland, when these rapid means of communication are made subservient to the wants of all classes in every nook of the island. *Having shortly dwelt on the great importance of railway communication*, the author describes the counties and districts through which were to pass the two great lines—one to the south-west, and the other to the north-west, from Dublin, as proposed by the railway commission of 1838, under the guidance of the late Mr. Drummond and Sir J. Burgoyne, but which, owing to the principles of Government control advocated, and other [illegible] interests, the provisions of the report have not been in any one instance carried into effect, and the improvement of the condition of the people, which its authors had so fondly anticipated, remains as distant as six years ago, when the report was written. This part of the work closes with descriptions of various principles of locomotion, and fixed traction on railroads, with the steps necessary for going before Parliament, and other details connected with the subject, from the first proposition for its formation to its completion and opening.

In the closing chapter of the work are considered several staple commodities of Ireland—cotton, wool, and salt. Cotton wool, as not being imported direct into Ireland, he touches upon briefly, but observes, that it will indeed be an epoch in the history of Ireland when a bale of cotton from *New Orleans* is spun or wove at Killaloe, and in part returned as printed calicoes or muslins to the United States. The man who first accomplishes that, or an equivalent result, will have effected a revolution. The woollen manufacture has been at all times considered of high importance in Ireland, and a large quantity of wool is grown there—the grazing counties of the limestone plain affording an herbage peculiarly agreeable to sheep, and the total number is somewhat above two millions; a great portion of this wool is exported to other countries, particularly to France, but were the wool grown in Ireland manufactured in it, there is no doubt but so great an amount of mechanical industry would be called into play as would afford employment to a large portion of the people. Another substance, which forms the basis of more chemical manufactures than any other, is salt; it yields chlorine, and is thus the original material of all the harmful acts which involve bleaching processes; and soda, an ingredient in soap, in glass, and numerous other substances, in curing provisions, as a condiment, and as a manure, it is most extensively used. Of this important substance there is no natural deposit in Ireland, and the manufacture by the evaporation of sea water, by the use of turf, would cost at least 25s. per ton, while the ordinary English salt seldom costs more in Liverpool than 10s. or 11s. per ton. With respect to the cost of labour in Ireland, it can be obtained on lower terms than almost any other country in Europe—8d. or 10d. per day being the usual rate of wages; this nominal cheapness is, however, by no means commonly economical in final cost. A poor man, who can only earn by his exertions 4s. or 5s. per week to support a family, must be so ill fed and depressed in mind, that to work as a man should work is beyond his power; hence are often seen about employments in Ireland double the number of hands which would be required in England; the latter would, probably, be paid twice as much, but in the end the work would cost most more. With respect to the physical development and strength of Irishmen, when at all well fed, the following table shows them to be the tallest, heaviest, and strongest, of the four races named below—viz.:

Nation.	Av. height in inches.	Av. weight in pounds.	Av. strength in pounds.
English	66½	141	468
Scotch	69	143½	452
Irish	70	154	482
Belgians	66	140	399

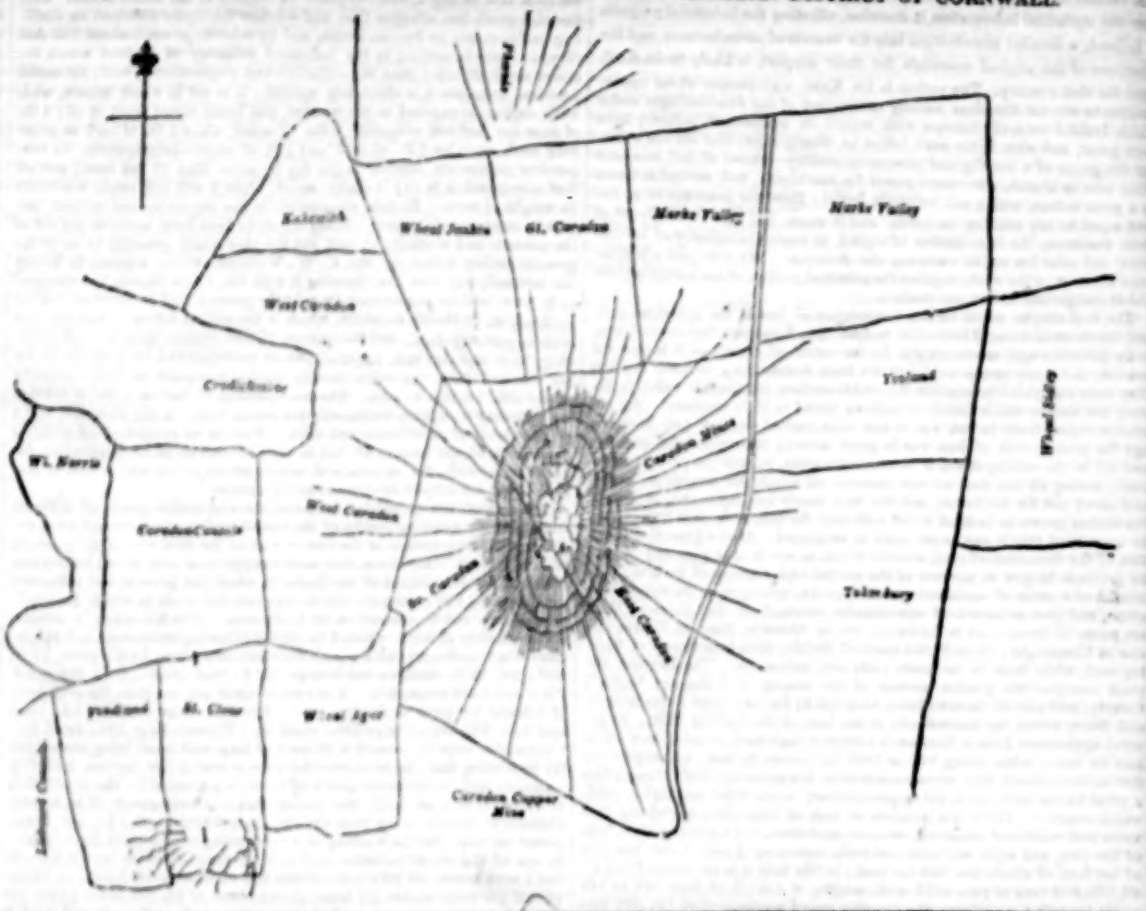
The author then alludes to the evils of combination among workmen, for which he truly says there is but one remedy—education; and he observes, that as far from the habits of the working classes of this country being adverse to the introduction of industrial occupations, they have made within the last few years unparalleled strides in habits which lead to industrial success. He does not hesitate to assert that the existing government in that country is half a century in advance of that which is dying off, and that the generation now at school will be a century in advance of the present one. Formerly the inhabitants were reckless, ignorant, drunken, improvident, and idle—that time has passed away for ever. We shall close our notice of this interesting and instructive volume with an extract from the author's remarks on industrial education. He says:—"A person about to be educated for industrial purposes should be first thoroughly grounded in the general principles of the natural and physical sciences and elementary mathematics; then pass to a special branch, according as he is to be a chemist, a maker of machines, or worker in metals, or other trade; to this should follow the experience of the workshop. The simplest operation in the arts requires a degree of manipulative skill which no books, no words, can give; the most theoretical acquaintance with the construction of machines will not make a man a good workman. The ultimate object of the previous discipline is science is to enable him fully to avail himself of the opportunities of improvements in his art which the working continually affords."

ON THE MARBLE QUARRIES OF MACAEL.

The southern slope of the Sierra de Buenos, between the towns of Pinos and Macael, in the province of Almeria, is composed in its inferior part of micaceous slates, and in its superior of a calcic sacaroidine, or marble, which alternates with argillaceous and granitiferous slates, all of them belonging, probably, to the primitive formation. The marble, which is streaked with much regularity, offers generally an agreeable whiteness of aspect, with bars and flues spots of blue, which contribute to augment the variety of the works in support to this marble, and also its value and importance. Throughout the district of Macael a number of quarries are met with, whose exploration goes back to the most remote antiquity, and from which came the beautiful marbles with which the Moors of Granada decorated the sumptuous Alhambra, those which were after words employed in the cathedral of that city, and even those, at an epoch much more distant, with which the Carthaginians and Romans embellished the cities of the southern coast of Spain, which they in turn conquered and colonized. At present there are in the small town of Pinos, which is distant one or two leagues from the different quarries, two establishments for the working of marble. The first of these was commenced in 1830 by a Catalonian company, has an hydraulic wheel of 11 palmos in diameter, moved by the water of the river Almanzora, which gives motion to four frames of fifteen saws each, which all go together, and produce in a week from sixty to sixty-eight tabular pieces of square dimensions. The saws are nothing but pointed sawn blades of iron without teeth, suspended at the two extremes to the frame, and placed parallel to each other, and at such distances as are required for the dimensions of the tablets to be produced. This establishment, which cost from 14,000 to 15,000 duros, experienced at first, and still experiences, frequent observations, partly from some derangement in the apparatus, and partly from the abundance of slime from the river. The other factory was opened in 1841, and has continually four hand saws in operation, also operating by hand all the other operations of polishing, &c. About 200 persons are employed in both these establishments, whose wages are about 150,000 reals annually.—*Boletin Oficial de Minas.*

CHEMICAL DISCOVERY OF THE SILICA RATS.—Mr. Robert Hunt has communicated to the Royal Cornwall Polytechnic Society the results of some recent experiments made by him, with a view to determine the influence of the solar rays in promoting chemical change. After alluding to the chemical discoveries which take place in all the photographic preparations, and to the action of nearly all the metals when in contact with exposed bodies, proceeded to mention some very remarkable changes which we had found to occur in paper, metallic and other substances. Mr. Hunt stated that exposure of iron to sunshine promoted silver and gold from their solutions. Now, if any portion of this rust subjects to light in the dark, and the other portion is exposed to sunshine, they act very differently with the solutions of gold or silver. The substance which has been exposed to the sunshine precipitates the other metal immediately—whereas, that which has been protected in darkness requires several hours to complete the precipitation. Many other cases of the most singular kind were described, and the peculiarity has been traced entirely through many of their chemical relations. In addition to these, a curious arrangement of wax tablets, by which, in the dark, a presentation of beautiful silver was produced on glass plate. The same arrangement being exposed to sunshine, the presentation was entirely destroyed. These evidences was adduced that the solar rays tend to some considerable extent, active in destroying the cohesion of chemical affinity and the agency of chemistry.

HAND SKETCH OF MINES IN THE CARADON DISTRICT—EASTERN DISTRICT OF CORNWALL.



TUBULAR BOILERS.

Tubular boilers in steam-vessels are fast coming into universal use, and, as we think, deservedly; but many of those that have been constructed hitherto have been defective, from a want of steam room and tube surface. We may mention the *Sydenham*, which is a vessel with American engines, but the boilers were made in Woolwich Dockyards, and are of the usual kind of tubular boiler fabricated there. The tubes and end plates are of brass. Fire grate surface 42·6 square feet = 0·70 H.P. = 340 square feet, per H.P.; heating surface of tubes, 720 square feet; heating surface of furnaces and flue, 134 square feet—total, 920 square feet = 7·6 H.P. = 11·9 square feet per horse power. These boilers have been found to give a good supply of steam, and even with smoky coal on a long voyage there is but little collection of soot in the pipes. The boilers of the *Bregenzia* have a large tube surface, and also good steam room. They are capable, moreover, of working at a high pressure, and yet the water level is not injuriously contracted by the form of the boiler top. While speaking of boilers, we may as well say a word or two on the subject of long furnaces, a peculiarity we have often taken occasion to reprehend, yet we find that they are still retained in some places. The *Royal Adelaide*, for example, with boilers by Mr. Maudslay, of Lolth, has furnaces of ten feet long, and the consequence is, the vessel is but poorly off for steam, and the consumption of fuel is serious; whereas, if the fires were only five feet long, the consumption of fuel would be less, and there would be a better supply of steam. Absurdities grate surface, indeed, is a good thing, but it must not be reached by extending the length of the furnace beyond four and a half, or, at most, five feet, for the after end of a very long furnace cannot be fired properly on a long voyage at sea, and its only effect is to weaken the efficacy of the other portion. We wish Mr. Maudslay would try the effect of shortening the bars, and giving them a greater inclination; we are convinced he would find an advantage in the change.—*Artizan.*

APPLICATION OF SLATE IN THE FINE ARTS, &c.

The rapid strides which are continually making in the arts and sciences, and the numerous specimens of new productions, or improvements upon the old, which are daily brought under notice, so familiarize the senses to novelty, that it must be something of surpassing attraction that will now command attention and insure an impartial investigation into its merits. The simple article slate, which, a few years since, was limited upon only as a means of roofing, and for some very few other purposes, is now becoming of immense importance, not only for a variety of domestic purposes, but in articles of elegance and luxury—it will, in all probability, soon, in many cases, supersede the finer marbles. At the Pinxton Slate-Works, Messrs. Magnus and Co. have succeeded in perfecting some most extraordinary productions from this useful material, the capabilities of which are at present but little known. By chemical agents, which impart the most brilliant colours to the surface, and which are afterwards burnt in, they imitate all the costly varieties of marble —*Verde antique, Lapis lazuli, Negro antique, Sienna, Jasper*, &c.—to such perfection, that the profoundly connoisseur is entranced to deceive the eye and the touch of the most experienced means; and from slate thus prepared are manufactured tea, toilet, dressing room, and ladies work tables, chimney pieces, brackets, balustrades, cornices, mantelings, finger plates, and knobs for doors; in fact, there is scarcely an article of utility or elegance to which marble, wood, &c., can be applied, but what this elegant production will be found a substitute for. At the manufactory over the window sashes and frames and doors are made of slate. The perfect jet black of this material renders it most suitable for monumental and mural tablets; and, unlike black marble, it retains its rich polish under exposure to the atmosphere. The ornamental designs, such as flowers, foliage, arabesque borders, landscapes, &c., are first-rate specimens as works of art. Billiard and bagatelle tables, the legs, frame, and bed, all of slate, are made at these works, beautifully finished in enamelled designs; and a table thus constructed can never warp or get out of level, whatever may be the changes in the atmosphere. The Duke of Wellington has one at Strathfieldsaye, and there is one practically at sea, at this time, in the above room. With a strength far above that of marble, and even far beyond that of Yorkshire stone, it must soon supersede many other material for domestic purposes, such as sinks, selling, tanks, and with cements, pantry slabs, &c.; its chemical, cool, and non-absorbent qualities rendering it most applicable to such purposes; and, in fact, in the washing, grocery, stable, kitchen, brewhouse, wine cellar, laundry, &c., the purposes to which it may be applied are infinite. The slate employed in these quarries worked by Messrs. Magnus, is Matlockshire; it is of a fine close colour, free from spots or blemishes of any description—is quarried in blocks and afterwards cut, planed, smoothed, and polished by powerful machinery, at the Pinxton works, which are well worthy of inspection. On Wednesday week Prince William of Prussia, accompanied by the Duke of Wellington, inspected the works, and expressed his high admiration at the perfect imitation of the most costly marbles and precious minerals; among the latter, if there is one specimen superior to another, it is *Lapis lazuli*—the delicate ultramarine ground and veins of rich pure gold colour, so beautifully displayed in that mineral, are but ill set by imitation, and was likewise the eye of a connoisseur. The Duke has for some time past paid much attention to this new and elegant art, and has extensively patronized the works; in some time since the splendid specimens by Colonel Mayhew, to Hong Kong, and some considerably extensive orders have in consequence been received from China for baths, tables, and other articles, and its use in this country is rapidly extending.

[From a Correspondent.]—The invention of Mr. Magnus, the proprietor of the extensive slate works at Pinxton, by which he has been enabled to produce such exquisite imitations of the marbles and stones of England, Siberia, and Italy, is engrossing no common public attention, and it is true it should do so, the company visiting them (especially on a week appointed to ornamental subjects and decorative art), as connected with buildings, has for many years been discovered. Those who have not the leisure to visit the works at Pinxton, can inspect a beautiful variety of specimens which have been recently added to the museum of the Polytechnic Institution, Regent-street.

A SUBJECT FOR.—The principal features in this plan was taking advantage of the ascending power of steam, and placing an orifice in the pipe with a flexible metal, thus securing the safety of the boiler under circumstances of danger arising from any undue increase of temperature.

IMPROVEMENTS IN STEAM-ENGINES.

In our notice of the Royal Cornwall Polytechnic Society's Exhibition, we announced that Mr. West had obtained a medal for an iron connecting piece for rods of pumping-engines.—At a subsequent period of the proceedings, Mr. R. Taylor gave a description of the invention, which is intended to be applied to large engines instead of wood; this was much wanted, in consequence of many of the best engines in the county having been knocked to pieces through the breaking of the wood rods. He had shown it to many of the engineers, who approved of it, and it was now about to be employed in a large engine (either of 80 or 85 inches) at the Fowey Consols. Mr. Taylor said, that although the judges had given a prize to this rod, they did not mean to say that it would be sufficient—it was a matter to be tried. The accidents to which wooden rods were liable arose chiefly from decay; in some of our deepest mines the atmosphere is very much heated, and the current of warm air passing through the engine-shaft had a great tendency to produce dry rot. The strength of iron rods admitted hardly of a doubt; they might be made of any required strength, and their durability was also self-evident—the doubt that arose was rather as to their economy than as to their efficiency. There was but one opinion among the judges as to the excellence of the construction of the rods, supposing that it was found by practice that iron rods were durable. Mr. Taylor explained the model, after which he observed, that he had a calculation, which had been made rather hastily, perhaps, of the comparative cost of iron and wooden rods, which might be interesting to them, and he would give some of the leading features of it. He found that iron rods for an engine of the largest class now working, for the 85 inch engines, would cost 11*l.* 4*s.* per fathom—that is, calculating on the use of rods 6 inches wide and 2¼ thick, which, with the connecting parts at every 24 fathoms, would weigh 2¾ cwt. Some of the deepest engine-shafts would require 300 fathoms of connecting-rods, but the weight would diminish; the second hundred fathoms would be about two-thirds the weight of the first, and the third would not be more than half the weight of the upper. The first hundred would cost 1140*l.*, the second 760*l.*, and the third 570*l.*—in all, 2470*l.* Now that certainly did seem a very large sum to be expended merely in the pump rods. When they considered the expense of all the other parts of the apparatus for a pumping shaft—the steam engine, the timbering of the shaft, and the pumps themselves—it did seem a very large outlay for the advantages which they expected to derive from their use. He should now state what would be the expense of wooden rods of the same kind. The weight and cost of wood rods connected in the usual manner with iron plates and pins, and of the necessary size and strength to be equal to the parts of an engine of the largest class, would be 4*l.* 9*s.* per fathom for the first hundred fathoms—that is, the wood would cost 2*l.* 5*s.*, and the iron-work 2*l.* 14*s.* The first hundred fathoms would be 1140*l.*, the second 760*l.*, and the third 380*l.*—making 1140*l.* altogether. Therefore the comparative cost of wood and iron rods would be—for wood 1140*l.*, and for iron 2470*l.* Now, he should at once state that the estimate of the cost of iron rods was not that of the inventor, and very possibly he might question his (Mr. Taylor's) facts, and say that he overcharged the cost of the rods; he should, therefore, state the mode of calculation. He had given the size that he thought necessary, on the authority of Capt. W. Bennetts, of the United Mines, who was very well acquainted with all such matters. He said the rods should be 6 in. wide, and 2¼ in. thick; and he supposed that these rods would cost 10*s.* per cwt. That was the price which they were now paying for work of this kind, in which the best iron is used. There were other considerations which should be taken into account; economy was not all that should guide them in this important matter. If these iron rods were perfectly secure against accident, or more secure than wooden ones, they should do well to pay more than for wood. But he had his doubts whether in engines worked expansively, as the Cornish engines were worked, and with such sudden impetus, iron would be found as good as wood. When iron broke, it broke suddenly, giving no warning; wood sometimes broke without warning, but very frequently there were symptoms of decay before an accident happened—and, within his own experience, he could report numbers of instances where engine-men had come and told that such a rod was failing. Now, he doubted very much whether they should calculate on that with iron; but he fully agreed with the judges, that this rod deserved a reward for its construction, and that the experiment was worthy of being tried—and all the miners in the county would be greatly indebted to Mr. Taylor if this rod was tried with the first steam engines in Fowey Consols, and if it was found good policy to dismiss wood and adopt iron.

THE POETRY OF MINING.—PART II.

THE ARTS AND ADVENTURERS.—*continued.*

The poetry of life we love,
Of morning, noon, and eve—
Its pictures, past, and future smile,
Of all enspiriting genius,
But not a tale of golden fame shine
From range of darkest grimmest mine!

Oh! Fancy, in her dreamy sight,
With gleam the spirit's wings,
Its glow, the sun hits, from a mine,
Beneath the waste of kings,
Where gold has made the light to shine
From brass, sconce, or copper shine.

Like gems of chasms or alleys—
If direct gentle love—
Adventurous souls, where only they've
Incognito,
Where crown'd the quality,
Aye! There's an equipment divine,
Whose thanks to gold is lent the mine!

The poet soul is sensitive too much,
To dare gentle, too;
For what has ever done by
Great gentle, than of "Coal" a Grim,
Of dread to a shaft in working mine
Pandemonic, coin.

To stand by death tool's sinking eye,
Or explosion—widower—sight;
All need to pay the dead man's debts—
Ah! this is poetry!
But not the time of continued sighing
O'er the last colour of a mine.

Where we discover a partnership
Troublesome or workmen part,
To have to pay each other's debts,
In quarter arrears!
But not the time of continuous prying
For extremity of the dwindling shaft.

To read of superintendent's duty,
And spirited gaiety for words,
Or talking daily what they thought,
Will take such's talent to write;
But, Sir, the deadly work to sight
The sombrest coat of Cornish mine!

To get or lose at wheel or chain,
Will win the most wished,
Or Shareholder's smiles will the most
Of spinning matter be
But, Sir! the poetic of mine,
To share the profits of a mine!

[illegible] E. A. Rundle.